

REMARKS

This is a full and timely response to the outstanding non-final Office Action mailed November 8, 2004. Upon entry of the amendments in this response, claims 19 – 25 and 27 - 41 remain pending. In particular, Applicant has amended claim 19, 25, 27, 31 – 34, 36, 37, 39 and 40, and has canceled claims 1 – 18 and 26 without waiver, disclaimer or prejudice. Applicant has canceled claims 1 – 18 and 26 merely to reduce the number of disputed issues and to facilitate early allowance and issuance of other claims in the present application. Applicant reserves the right to pursue the subject matter of these canceled claims in a continuing application, if Applicant so chooses, and does not intend to dedicate the canceled subject matter to the public. Reconsideration and allowance of the application and presently pending claims are respectfully requested.

Election/Restriction

Applicant acknowledges the previous election, without traverse, to prosecute the invention of Group II, claims 19 – 41.

Rejection under 35 USC § 112

The Office Action indicates that claims 31 – 33 and 39 - 40 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicant regards as the invention. As set forth above, Applicant has amended these claims and respectfully asserts that the rejections have been rendered moot.

Rejection under 35 USC § 102

The Office Action indicates that claims 19, 23, 26 – 30 and 33 stand rejected under 35 U.S.C. § 102(e) as being anticipated by *Kakamu*. As set forth above, Applicant has canceled claim 26 and respectfully asserts that the rejection as to this claim has been rendered moot. With respect to the remaining claims, Applicant respectfully traverses the rejection.

In this regard, *Kakamu* discloses a semiconductor device and method of manufacturing the same. Specifically, referring to FIG. 31, a conductive plug 131 is substantially filling the hole in an insulating layer 251. A SiC film 171, serving as an etching stop layer, is formed on the insulating layer 251 and conductive plug 131. A SiOC film 161, low dielectric constant layer, is formed on the SiC film 171 for formation of a trench to fill Ta film 191 and Cu film 201. A trench is formed in the SiOC film 161 and the SiC film 171.

In contrast, amended claim 19 recites:

19. A metal structure, comprising:
 - a semiconductor substrate with a conductor thereon;
 - an insulating layer overlying the semiconductor substrate having a hole therein exposing the conductor;
 - a conductive plug substantially filling the hole and electrically connecting the underlying conductor;
 - a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, overlying the insulating layer and the conductive plug;***
 - a low dielectric constant layer overlying the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;
 - a trench in the low dielectric constant layer and the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;*** and
 - a copper or copper alloy conductor substantially filling the trench, electrically connecting the conductive plug.

(Emphasis Added).

Applicant respectfully asserts that *Kakamu* is legally deficient for the purpose of anticipating claim 19, because at least the features/limitations emphasized above are not taught or otherwise disclosed by *Kakamu*. Therefore, Applicant respectfully asserts that the amended claim 19 is in condition in allowance.

Since claims 23, 26-30 and 33 are dependent claims that incorporate the features/limitations of claim 19, Applicant respectfully asserts that these claims also are in condition for allowance. Additionally, these claims recite other features that can serve as an independent basis for patentability.

Rejection under 35 USC § 103

The Office Action indicates that claims 20-22, 24, 34-35, 37-37, 41 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Kakamu* in view of *Agarwal*; that claims 25, 31-32 stand rejected over *Kakamu* and *Agarwal* and further in view of *Engel*; and that claims 36, 39-40 stand rejected over *Kakamu* in view of *Engel*. Applicant respectfully traverses the rejections.

As set forth above in the discussion of rejections under 35 U.S.C. 102, Applicant noted that *Kakamu* does not teach or otherwise disclose at least several features recited in claim 19. Specifically, *Kakamu* does not teach or otherwise disclose “a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, overlying the insulating layer and the conductive plug” or “a trench in the low dielectric constant layer and the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide.” Applicant respectfully asserts that neither *Agarwal* nor *Engel* teaches or reasonably suggests these features. Therefore, Applicant respectfully asserts that the combination of references is legally deficient for rendering these claims unpatentable.

Additionally, Applicant respectfully asserts that providing a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer between regular-k and low-k dielectric, provides better adhesion/glue capability than SiC. The carbon-doped silicon oxide has a relatively lower k-value than SiC. Since these features and/or the desirability thereof is neither taught nor reasonably suggested in any of the cited references, Applicant respectfully asserts that the pending claims recite limitations that patentably define over these references.

In this regard, claim 34 recites:

34. A metal structure, comprising:
a semiconductor substrate with a conductor comprising nickel silicide thereon;
an insulating layer overlying the semiconductor substrate having a hole therein exposing the conductor;
a conductive plug substantially filling the hole and electrically connecting the underlying conductor;
a carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide, serving as an etching stop layer, overlying the insulating layer and the conductive plug;
a low dielectric constant layer overlying the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide;
a trench in the low dielectric constant layer and the carbon-doped silicon oxide or carbon and nitrogen-doped silicon oxide; and
a copper or copper alloy conductor substantially filling the trench, electrically connecting the conductive plug.

(Emphasis Added).

Applicant respectfully asserts that the cited references, either individually or in combination, are legally deficient for the purpose of rendering claim 34 unpatentable. Specifically, Applicant respectfully asserts that the references do not teach or reasonably suggest

at least the features/limitations emphasized above in claim 34. Therefore, Applicant respectfully asserts that the amended claim 34 is in condition in allowance.

Since claims 35 - 41 are dependent claims that incorporate the features/limitations of claim 34, Applicant respectfully asserts that these claims also are in condition for allowance. Additionally, these claims recite other features that can serve as an independent basis for patentability.

Similarly, Applicant respectfully asserts that the cited references, either individually or in combination, are legally deficient for the purpose of rendering claim 19 unpatentable. Specifically, Applicant respectfully asserts that the references do not teach or reasonably suggest at least the features/limitations emphasized above in claim 19. Therefore, Applicant respectfully asserts that the amended claim 19 is in condition in allowance.

Since claims 20 – 25 and 27 - 33 are dependent claims that incorporate the features/limitations of claim 19, Applicant respectfully asserts that these claims also are in condition for allowance.

Cited Art of Record

The cited art of record has been considered, but is not believed to affect the patentability of the presently pending claims.

CONCLUSION

In light of the foregoing amendments and for at least the reasons set forth above, Applicant respectfully submits that all objections and/or rejections have been traversed, rendered moot, and/or accommodated, and that the now pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Daniel R. McClure', is written over a horizontal line.

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